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Management of groundwater resources for protection of native vegetation

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Introduction

The Perth region, which has a population well over one million people, is underlain by significant fresh and brackish groundwater resources. These resources play a very significant role in the lifestyle of the people who live in the area. The increasing demand for these groundwater resources among competing users is requiring more effective planning and management strategies.

Water Authority activities have considerable potential to impact on wetlands and *Banksia* woodlands, as direct impacts from the provision of water services such as the construction of water and sewer mains and the less obvious impacts from the management and development of the groundwater resources.

The Resource

Underlying the Swan Coastal Plain to depths of 14 km are large groundwater resources. These occur as the unconfined water-table aquifers which constitute the major Gnangara and Jandakot groundwater mound systems and as confined groundwater. Recharge to these systems is directly from rainfall. Some of the confined groundwater is artesian to the extent that pressure heads are above the land surface.

Whilst these groundwater sources are relatively large, at least in the local context, the increasing demands are such that careful management is required to ensure equitable use and to protect water quality. Unlike many other commodities, management of Perth's groundwater resources is undertaken in accordance with the concept of sustainable yield as defined under the State Conservation Strategy (Department of Conservation and Environment 1987).

The concept of sustainable yield applies particularly to fresh resources and requires that abstraction is maintained within limits that can be sustained in perpetuity without adverse effects on the beneficial uses of the resource.

Current Water Use

Total water consumption within the Perth region (between Gingin and Rockingham) is close to 400 million m^3 annually of which approximately half is supplied by the Water Authority and the remainder is extracted by private users (Webster 1989). In 1985, 262 million m^3 were obtained from groundwater sources of which 206 million m^3 were extracted privately and the remainder was pumped by the Water Authority from public water supply areas.

The importance of the shallow unconfined aquifer can be seen by the fact that of the 262 million m^3 of groundwater used some 223 million m^3/annum were from the shallow aquifer.

This water is used for a range of purposes, namely private domestic irrigation, local authority and institutional parks and gardens, Water Authority public supplies, horticulture and industrial and commercial purposes.

Other important users of the shallow unconfined groundwater in the Perth metropolitan region are the wetlands and the areas of lowland vegetation including *Banksia* woodlands.

Future Water Use

The Source Development Plan for future development of water supply sources for Perth's public water supplies identifies sources for the next 25 years of Perth's development (Water Authority of WA 1987). Within this plan, groundwater sources continue to play a prominent role, with groundwater being expected to contribute in similar proportion to the current one-third of the total public supply.

By the year 2000, based on current trends, it is estimated that the total water consumption in the Perth metropolitan region could be close to 550 million m^3/annum of which 350 million m^3/annum could come from groundwater resources.

The value of these resources is considerable. If the fresh shallow groundwater resources in the Perth region were valued entirely in terms of their potential for public water supply, their net present worth would be in excess of $1000 million. Their value in terms of other potential uses would be less in some instances, and more in others. The value in environmental terms is difficult to estimate but relates at very least to the high value of the quality of life that we enjoy in Perth.

The importance of groundwater to existing future public water supplies lies in its proximity to centres of demand. For example, the Gnangara Mound is adjacent to the North West Corridor, and its attribute of large storages compared to replenishment rates allows water to be borrowed from these storages in drier periods.

There are, however, some quite contrary aspects to these positive attributes. The proximity of groundwater to the urban demand centres is seeing pressure for the urban development to move onto the primary groundwater source areas with the consequential threats of degradation of these sources. The need to maintain groundwater levels within limits necessary to support environmental requirements is requiring the Water Authority to review its use of unconfined groundwater as a drought protection strategy and to review its policy of firm licensed allocations to private users. These conflicting requirements of the groundwater resource increase the need for management of not only the water resources but of the land uses in the surrounding area.

The main pressure regarding groundwater quantity relates to the increasing competition from the users of these resources.

Groundwater Allocation Strategy

Deciding how to manage groundwater resources to meet increasing competition is not easy. In broad terms, the competing uses are public water supplies, private use, and the environment. It is thus a matter of determining how a finite resource can be shared equitably between the users.

In the past, the management of water resources of the State has been undertaken largely through the proclamation of water resource management areas *ie* Catchment Areas, Water Reserves, Groundwater Areas and Public Water Supply Areas. This provides the Water Authority with statutory mechanisms to ensure that activities do not degrade the quantity and quality of water and to allocate the resource.

To a large extent, the proclamation of water resource management areas has also allowed for protection of the environment. A good example of this is the Gnangara Water Reserve. This area of 835 km^2 on the Gnangara Mound between Gnangara Road and Gingin Brook was proclaimed in 1973. Although a considerable proportion of this area is pine plantation, the largest part is either State Forest or vacant crown land which is mainly vegetated with *Banksia* woodland. Large areas of the Gnangara Mound *Banksia* woodland are now proposed for more secure vesting in the Department of Conservation and Land Management's latest regional management plan-*eg* Carabin, Wabling and Yeal Nature Reserves (CALM 1987). Without the proclamation which was originally aimed at protecting the water resource, some of these areas would probably have been subdivided for agricultural purposes.

Because of increasing competition for a limited resource, management of water resources is now significantly more complicated. Satisfying this emerging competition and resolving the conflicts are the fundamental objectives of the water allocation process. This process will become increasingly complex as community water demands grow.

For water allocation strategies to be successful, they will need to become part of a wider strategic plan. The traditional approach of allocating water to specific individual users for specific purposes needs to become part of a process of developing regional land and water resource strategy plans.

These strategy plans should include a hierarchical process that will ensure adequate protection of the water resource for the intended uses. The highest level within this hierarchical process should be allocation of priority beneficial uses to the water resources of a region or basin. Such an allocation defines the primary desirable use or uses for a specific water resource in the long term.

These priority beneficial uses fall into two broad categories of:

- environmental and recreational uses; and
- consumer uses (public and private water supply).

The next level of allocation should specify the bulk allocations for particular uses within the identified priority beneficial use. An example of bulk allocation within the consumer uses category is between public and private water supplies where the usage by each is broadly constrained within specified annual abstraction volumes.

The lowest level of allocation that has been actively used in resource management is the individual user allocation or licenced allocation.

It is proposed that these water allocation principles will be embodied into a Environmental Protection Policy under the Environmental Protection Act, for the Gnangara Mound. This will offer greater protection to both the water resource and the environment.

Protection of Lowland Vegetation

The Water Authority is very aware of its responsibility to manage groundwater levels to protect the environment. The Minister for Environment has set a number of conditions on the next phase in the development and management of the Gnangara Mound groundwater resources. These conditions are founded on ensuring adequate conservation and management of wetlands. In protecting wetlands, they also protect lowland vegetation surrounding wetlands.

Future extensions of wellfields on the Gnangara Mound are aimed at keeping wells in upland areas where the vegetation is not dependent on the water table for its water supply.

The Water Authority now monitors a significant number of vegetation transects on both the Gnangara and Jandakot Mounds. Monitoring commenced on some of the 14 sites in the Gnangara Mound as early as 1966 when the Forests Department established four transects. The monitoring has so far shown that climatic factors have the major effects on the *Banksia* woodlands with many areas being drought affected in recent years and succession occurring from water loving species to more drought resistant species. (Mattiske & Associates 1988).

Certainly there have been some dramatic effects on local areas in the vicinity of wells which must be attributed to pumping. These are now being carefully monitored. It appears the main reason for *Banksia* deaths was the sudden drop in water table level occuring soon after the commissioning of wells. The Water Authority is looking at means of avoiding this such as developing the full yield for new wells over more than one year to give the trees time to adapt to lower water tables. An additional new transect has also been established radiating out from one of the new Pinjar bores to monitor the effect of the pumping strategy.

Five vegetation transects have recently been established on the Jandakot Mound to provide baseline monitoring as part of the Environmental Impact Assessment for the Jandakot Groundwater Scheme Stage 2. Developing environmental criteria for valued areas of the environment including *Banksia* woodlands in Jandakot area is a key component of the early stages of this environmental assessment.

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